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PROCEEDINGS OF THE 40<sup>TH</sup>  
ANNUAL MEETING OF THE  
TRANSPORTATION RESEARCH FORUM

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Philadelphia, Pennsylvania  
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Volume 1

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## Welcome to the Transportation Research Forum's 1998 Annual Meeting

These proceedings contain those papers presented at the 40<sup>th</sup> Annual Meeting of the Transportation Research Forum, held in Philadelphia from October 29-31, 1998, that were received by the deadline publishing date. All papers were reviewed by the Program Vice President to assess their suitability for inclusion in these volumes. Additional papers may be made available by some of the presenters at the time of the Conference.

The Transportation Research Forum (TRF) is an independent organization of transportation professionals providing pertinent and timely information to those who conduct research and those who use and benefit from research. It functions as an impartial meeting ground for carriers, shippers, government officials, consultants, university researchers, suppliers, and others seeking an exchange of information and ideas related to both passenger and freight transportation. The Transportation Research Forum started with a small group of transportation researchers in New York in 1958 and the first national meeting was held in St. Louis in 1960. National meetings have been held annually since 1960 at various cities throughout the U.S. and Canada.

Numerous TRF members and supporters aided in the development of this year's Forum, but it is authors of the papers, the organizers and contributors to the various panels, and the session chairs who make TRF annual meetings so worthwhile and enjoyable. The conference program simply reflects the interests, enthusiasm and commitment of those members of the transportation community. Special thanks go to Patrick and Judy Little who graciously agreed to assemble this year's proceedings for me. Without their help, the job of Program Chair would have been much more of a burden.

A number of other TRF members also assisted in the development of this meeting. Randy Resor and Jim Blaze were constant sources of ideas and encouragement. When help was asked for, they came through repeatedly. Other TRF members provided help with the program in their areas of interest. I want to thank Alan Bender, Michael Belzer, Ken Erickson, Paul Gessner, Harold Kurzman, Scott Ornstein, Clint Oster, and Peter Smith for their help. Claire LaVaye at the University of Texas assisted with promoting the meeting on TRF's website. Finally, Rick Guggolz provided valuable assistance on the business arrangements for the conference.

We are also grateful to those companies and organizations who have sponsored awards or made other contributions to the success of the Forum. These include: LTK Engineering, The Metropolitan Transit Association, and RailTex. Among our own members, we are especially indebted to the TRF Foundation, the Cost Analysis Chapter and the Aviation Chapter for their assistance and support.

These proceedings are prepared and distributed at the TRF Annual Forum as a means of disseminating information and stimulating an exchange of ideas during the meeting. Every effort has been made to reproduce these papers accurately. TRF, however, assumes no responsibility for the content of the papers contained in these volumes.

Richard Golaszewski  
Program Vice President  
October, 1998

## Measurement Problems of Jointly Operated Commercial Aviation Flights

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### Abstract

This paper examines some of the problems in measuring commercial aviation service caused by various types of jointly operated and shared service arrangements. Commercial air carriers in international scheduled service operations are increasingly using these types of flights. These various seat swaps, blocked space and revenue sharing arrangements may make commercial sense for the air carriers but they complicate analysis for their competitors, policy-makers, regulators and investors. A traditional measure of performance such as "market share", designed in an era of single carrier service on individual flights, is complicated by flights operated by one carrier but marketed by more than one carrier.

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### Introduction

This paper will examine some of the problems in measuring commercial aviation services caused by various types of shared service arrangements that are being used by commercial air carriers in international scheduled service operations. These various seat swaps, blocked space and revenue sharing arrangements may make commercial sense for the air carriers but they complicate analysis for their competitors, policy-makers, regulators and investors. A traditional measure of performance such as "market share", designed in an era of single carrier service on individual flights, is complicated by flights operated by one carrier but marketed by more than one carrier. This problem has been the focus of debate by such groups as the International Civil Aviation Organization (ICAO) and the International Air Transport Association (IATA).

In his book on aviation policy in 1980, Dr. Taneja stated that "In international operations....One carrier will be at a considerable disadvantage unless it matches the frequency, and to some extent the aircraft type, of the competitor."<sup>1</sup> Carriers have found an easier method than matching flights to eliminate this disadvantage. Tom Peters predicted in 1991 that "More competition requires more cooperation" and "more joint ventures and partnership arrangements are required to thrive, especially overseas".<sup>2</sup> With code-sharing or joint flights, commercial airlines are increasingly putting their passengers and flight numbers on flights operated by others and doing the same in return for their code-share partners.

The United States Department of Transportation Accounting and Reporting Directive No. 217 defines code-sharing as "*an arrangement in which scheduled service is held out to the public in the name and code of an air carrier other than the air carrier that physically operates the aircraft in which the service is provided*". Jointly operated or code-shared flights are found in many markets, as they are a means for carriers to provide market presence at minimal cost. They can involve two or more carriers advertising and selling for carriage on a certain route where seats may be sold on flights actually operated by another carrier. In some cases, a carrier may use joint flights to enable it to sell travel on a city-pair where they do not actually fly by selling seats on their joint flight partners' aircraft. In other cases, even if they are in the market, jointly marketed flights enable them to sell service on more flights. For example, they may actually fly

a particular route three days a week but with a code-share they can also sell on the three days that their code-share partner flies.

One of the problems with defining reporting requirements for the jointly operated flights is that carriers have been very innovative at developing many methods of joint flight operation. Amongst those used include:

1. Trading of seats or "seat swapping" -- where a carrier "swaps the same number of seats over the same sector in the same class with another carrier"<sup>3</sup>. The timing for the swap could vary. One carrier could operate certain days of the week and another carrier other days of the week, with the swapping meaning that both can sell every day. The swap could be for another part of the year—one carrier could fly in the summer season and the other in the winter. The swapping could involve revenue transfers or the carriers may be permitted to keep all the revenues for all passengers carried on their operated flights. [While this paper covers only complications arising from code-sharing on non-financial measures, the complexities involved in how both revenues and expenses are shared also can create measurement problems.]
2. Blocked Space, unit price per seat ("soft block" or "non-risk") -- is an arrangement where a carrier pays a certain amount for any seat sold on the other carrier.
3. Blocked Space, flat rate for fixed block of seats ("hard block" or "risk") -- is an arrangement where the selling carrier must pay for a certain number of seats regardless of how many they actually manage to sell.

The world of code-sharing and jointly operated flights is becoming especially complicated as carriers enter into more and more relationships and alliances with different carriers. The code-sharing may be determined by the connection on the next leg, not just by one flight leg. An example is Business Express Airlines flight from Ottawa to Boston. If one connects with American Airlines in Boston, the flight out of Ottawa is considered an American Connection flight. If one flies Ottawa to Boston then connects with Northwest Airlines in Boston, the flight out of Ottawa is considered a Northwest Airlink flight. For all others the flight is considered a Delta Connection flight.<sup>4</sup>

### Impact on Traffic Flow Data

While the jointly operated flights are advantageous for a carrier's marketing presence, they can make statistical measurement of the market more difficult. For traffic flow surveys which measure the traffic between two points (often between foreign gateways) such as the U.S. Department of Transportation's "T100 Survey", the International Civil Aviation Organization's "Traffic By Flight Stage Survey" or Statistics Canada's "Airport Activity Survey", market share

information for jointly operated flights reflects only the operating carrier; the passengers for both the selling and operating carrier are shown under the operating carrier.

An example is shown below in Table 1. One flight departure, a Canadian Airlines International Ltd. aircraft, is marketed as a Canadian Airlines International flight, a Qantas flight and as an Air New Zealand flight. Although with a departing load of 100 passengers ticketed:

- 50 to Canadian Airlines International,
- 35 to Qantas, and,
- 15 to Air New Zealand

the traffic flow surveys of Statistics Canada, the U.S. Department of Transportation and the International Civil Aviation Organization would all record the flight as a 100 passenger flight by Canadian Airlines International. If one was trying to measure market share by national carrier using any of these three surveys, this could distort what is happening in the market.

**TABLE 1: JOINT FLIGHT AS REPORTED ON TRAFFIC FLOW SURVEYS**

Flight from Vancouver to Honolulu with 100 passengers aboard ticketed as shown below	Statistics Canada Airport Activity Survey	ICAO Traffic by Flight Stage Survey	US DOT T100 Survey
Flight CP1035 50 passengers	CP 100 passengers	CP 100 passengers	CP 100 passengers
Flight QF354 35 passengers		QF data not available	
Flight NZ335 15 passengers		NZ data not available	

Due to this inadequacy, Statistics Canada, since 1989 has collected supplementary information on its traffic survey "for reporting co-host data for joint agreement (scheduled) flights". The operating carrier is required to report the number of passengers that they carry for each co-host carrier on joint agreement flights. The number of flights and passengers affected by these flights is not insignificant. During the fourth quarter of 1996, there were 300,362 (an average of almost 3,300 per day) passengers reported as being carried on joint flights to/from Canada. This represented 6.1% of the total passenger traffic carried on major international scheduled services. From 1989 to 1996, the increase in the number of passengers carried on joint flights between Canada and other countries (excluding the United States) was fourteen-fold.

### **Impact on Operational Data**

The carrier actually operating a flight will typically have the information required to report the standard operating statistics:

- number of departures,
- hours flown,
- distance flown,
- aircraft type,
- number of seats available,
- number of passengers carried,
- number of passenger-kilometres flown,
- quantity of goods flown.

Therefore, where these data are required, it does make sense to ask the operating carrier to provide this information. This was the recommendation of the most recent International Civil Aviation Organization Statistics Division (September 1997) which recommended "for purposes of reporting air carrier statistics to ICAO, all operational and traffic items are to be reported by the operating carrier, including code-shared, franchised, pooled, blocked off charter, blocked space arrangements, joint services and leased aircraft services".<sup>5</sup> This was a change from its previous policy whereby, at least in theory, the seat-kilometres available, passengers and passenger-kilometres for jointly operated services were to be reported by the selling carrier. The operating carrier was to report only those seats, passengers and passenger-kilometres that they sold. An example of what this would mean for the reporting of a flight from Toronto to Dallas with a joint service is shown in Table 2.



**TABLE 2: REPORTING OF JOINT FLIGHTS ON ICAO TRAFFIC SURVEY,  
TRADITIONAL AND REVISED FOR JOINT FLIGHT REPORTING FOR ONE  
FLIGHT TORONTO-DALLAS**

ICAO A-1 Traffic Survey	Traditional Reporting	Revised Reporting
<b>Operating Carrier</b>		
Aircraft kilometres	1 928	1 928
Aircraft departures	1	1
Aircraft hours	3	3
Passengers carried	124	144
Passenger-kilometres performed	239 072	277 632
Seat-kilometres available	323 904	362 464
Passenger load factor	74%	77%
<b>Selling (Hosted) Carrier</b>		
Aircraft kilometres	-	-
Aircraft departures	-	-
Aircraft hours	-	-
Passengers carried	20	-
Passenger-kilometres performed	38 560	-
Seat-kilometres available	38 560	-
Passenger load factor	100%	-

While keeping load factor data for a market consistent by removing both the available seat-kilometres and passengers for the non-operating carrier, the previous ICAO policy could cause distortions if one tried to relate passenger capacity or passengers to hours flown or flight departures.

#### **Impact on Origin Destination Data**

The U.S. Department of Transportation has attempted to address the complication of code-sharing in its Accounting and Reporting Directive issued December 12, 1997 on "Passenger Origin-Destination Survey Operating and Ticketing Carrier Reporting, New Fare Basis Codes and Record Layout".<sup>6</sup> The justification for the change was that "the DOT has difficulty evaluating the effects of code-sharing alliances on air carriers and consumers".<sup>7</sup> The change was to require carriers to "report the ticketed carrier (carrier of record on the coupon) and the

operating carrier".<sup>8</sup> This should enable an analysis where one can examine either the marketing or the operating carrier for each stage of a ticketed journey.

For example, for a passenger with a ticket which reads United Airlines (UA) for his whole journey but who actually flies:

- Omaha to Chicago on United Airlines
- Chicago to Toronto on an Air Canada code-share
- Toronto to Sudbury on an Air Canada feeder code-share

United Airlines will report a three segment record with United Airlines as the ticketed carrier and with three different operating carriers (United Airlines, Air Canada and Air Ontario).

Two situations not corrected by the proposed changes to the O & D reporting are:

- where more than one carrier is involved in a code-share. For example, if a passenger is ticketed as an American Airlines passenger. They could travel on a Canadian Airlines International Ltd. flight under the American Airlines-Canadian Airlines International code-share agreement. If the Canadian flight out of Vancouver to Taipei is a Mandarin flight on which Canadian code-shares, there is no provision to report both Mandarin and Canadian in the US DOT proposal as there is no room in the existing record layout.
- where there is a code-share involving a carrier other than the reporting carrier at some stage of the passenger itinerary, this need not be reported. For example, if United Airlines is the reporting carrier, and the ticket shows a Chicago-Canadian Airlines-Ottawa portion at some point in the itinerary, United does not (as it probably cannot) have to show whether the operating carrier on the Chicago-Ottawa leg is American Airlines or Canadian Airlines.

## Conclusion

When analysing or using aviation data and especially market shares or nationality shares, the analyst/data user should be aware of how code-share or jointly operated flight data have been reported and tabulated. Where the ticketed carrier and the operating carrier differ, this can affect traffic flow, operational and origin/destination data. Producers of aviation data are slowly adjusting to this by introducing changes to their reporting instructions and surveys.

## Note

The views and opinions expressed in this paper are those of the authors and do not necessarily reflect those of Statistics Canada. We would like to thank Rolf Hakka, Tricia Trépanier and Dave Johnston for their valuable comments, corrections and criticisms while retaining all responsibility for any remaining errors.

## Endnotes

<sup>1</sup> Nawal K. Taneja, U.S. International Aviation Policy, page 58, (Lexington Books, Lexington, Massachusetts, 1980)

<sup>2</sup> Tom Peters, Thriving on Chaos—Handbook for a Management Revolution, (Harper Perennial, NY, 1991), pages 474-475

<sup>3</sup> Minutes of the meeting of the IATA Statistical Study Group, Hounslow Middlesex UK, 28th August, 1997

<sup>4</sup> Business Express Airlines advertisement, Ottawa Citizen, Saturday March 14, 1998, page A13

<sup>5</sup> International Civil Aviation Organization, Statistics Division, Report of the Ninth Session, Montreal, 22-26 September 1997, page 8, Doc 9703

<sup>6</sup> Office of Airline Information, Bureau of Transportation Statistics, Department of Transportation, Accounting and Reporting Directive No. 224

<sup>7</sup> Federal register, Vol. 62 No. 156, Wednesday August 13, 1997, page 43277

<sup>8</sup> Office of Airline Information, Bureau of Transportation Statistics, Department of Transportation, Accounting and Reporting Directive No. 224